



# National Bureau of Standards

## Certificate

### Standard Reference Material 4947C

Tritiated-Toluene Radioactivity Standard  
for Liquid-Scintillation Counting

Radionuclide	Hydrogen-3
Source identification	SRM 4947C
Source description	Liquid in a flame-sealed glass ampoule (1)*
Volume	4 mL (2)
Source composition	<sup>3</sup> H-Toluene
Radioactivity concentration	$3.081 \times 10^5$ Bq g <sup>-1</sup>
Reference time	March 4, 1987
Overall uncertainty	1.2 percent (3)
Measuring instrument	4πB liquid-scintillation counter (4)
Half life	12.43 ± 0.05 years (5)

This Standard Reference Material was prepared in the Center for Radiation Research, Ionizing Radiation Division, Radioactivity Group, Dale D. Hoppes, Group Leader.

Gaithersburg, MD 20899  
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Stanley D. Rasberry, Chief  
Office of Standard Reference Materials

\*Notes on back

NOTES

- (1) Ampoule contains approximately four milliliters of solution. Ampoule specifications:

body diameter	16.5 ± 0.5 mm
wall thickness	0.60 ± 0.04 mm
barium content	less than 2.5 percent
lead oxide content	less than 0.02 percent
other heavy elements	trace quantities

- (2) The density of toluene is 0.8669 g/cm<sup>3</sup> at 20 °C.

- (3) The overall uncertainty was formed by taking three times the quadratic combination of standard deviations of the mean, or approximations thereof, for the following:

uncertainties in <sup>3</sup>H-water 4927C

a) six gas counting measurements	0.05 percent
b) gram-mole measurements	0.08 percent
c) extrapolation and length-compensation in gas counting	0.03 percent
d) liquid-scintillation intercomparison of 1961 and 1978 <sup>3</sup> H-water standards	0.10 percent
e) half life	0.31 percent

uncertainties in comparison of <sup>3</sup>H-water and <sup>3</sup>H-toluene

f) seven liquid-scintillation measurements	0.06 percent
g) calibration curve	0.12 percent
h) gravimetric measurements	0.10 percent
i) quenching corrections	0.10 percent
j) dead time	0.05 percent
Combined uncertainty	0.40 percent
	x3
Overall uncertainty	1.2 percent

- (4) Eighteen vials containing <sup>3</sup>H-toluene were intercompared with 17 vials containing <sup>3</sup>H-water by liquid-scintillation (LS) counting. Each flame-sealed LS vial contained 15 mL of a 70/30 volume percent toluene/absolute ethanol scintillator (containing 3.7 g/L PPO and 0.5 g/L POPOP). Each sample also contained 50 to 100 mg of water. Quench curves prepared for the <sup>3</sup>H-water standards (SRM 4927-C) were used to assess the activity in the <sup>3</sup>H-toluene samples.

- (5) Mann, W.B., Unterweger, M.P., and Coursey, B.M., Int. J. Appl. Radiat. Isot., 33, 383 (1982).

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